mon base of the flagello, and in every instance observed, the act of ingestion was preceded by a quick bending of the larger flagellum by which the particle of indigo was thrown against the surface of the body in a manner similar to that described by Professor Clark in his observations upon Monas. So far as I was able to follow the process, whenever a colony reduced its rate of motion sufficiently to permit of careful observation upon this point, it was so much like the process described in Monas as to leave little doubt in my mind that it was substantially the same: although as I have said I did not *see* a distinct mouth.

Fig. 92.

A Single Monad.

It appears probable, now that the Monadina are better understood, that we shall soon be able to recognize in them a well-defined family of the Flagellate Infusoria, although doubtless many forms that have been assigned to that group are vegetable in their nature; these will be gradually removed and those forms which are unquestionably animal will be distinguished: among these it seems to me the genus Urella as described by Ehrenberg will undoubtedly take its place.

Figure 88 represents a colony of about forty monads; Fig. 89 an ideal section through such a colony; Fig. 90 represents a group of five; Fig. 91 of two, and Fig. 92 a single monad. I have attempted to sketch in this last the position of the large flagellum when throwing a particle of food against the mouth region.

All the above figures are enlarged one thousand diameters.

REVIEWS AND BOOK NOTICES.

Geological Survey of Ohio.*—Though this is but a yearly report of progress, yet it is an important contribution to American geology, both in its purely scientific and practical aspects. We are convinced that when the final reports shall be published, the citizens of the State of Ohio will feel proud of the thorough and able manner in which the survey has been carried on and com-

*Report of Progress in 1870. By J. S. Newberry, Chief Geologist. Including Reports by E. B. Andrews, Edward Orton, J. H. Klippart, Assistant Geologists; T. G. Wormley, Chemist; G. K. Gilbert, M. C. Read, W. B. Potter and Henry Newton, Local Assistants. 8vo, pp. 568, with maps and engravings.

pleted, and of the monument to scientific zeal and learning erected in the series of magnificent works which we are promised in the present report. We make a few extracts regarding the discoveries made by the survey. The fossil invertebrates are to be worked up by Profs. Hall and Worthen, many novelties having been found.

"The interesting collection of Amphibian remains, which includes more than a dozen species, obtained by myself some years ago from the coal rocks of Ohio, has been placed in the hands of Prof. E. D. Cope, of Philadelphia. He has described them and caused them to be carefully drawn. They supply material for six or more plates, which will add much to the interest of our final report.

The fossil fishes and fossil plants found in the State have been described by myself. They have been drawn by Mr. T. Y. Gardner and Mr. G. K. Gilbert in a style that has not been surpassed in this country, and some of their work is equal to any of a similar character done by the best European draughtsmen. The illustrations already prepared of this material form over forty plates; and I do not hesitate to say that the objects which they represent are not exceeded in scientific interest by any that have been described by palæontologists. The fossil fishes comprise many genera and species, some of which are more remarkable for their size, their formidable armament or peculiarities of structure than any of those which formed the themes of Hugh Miller's glowing descriptions. These have, for the most part, been found only in Ohio; have never been described and will not fail to deeply interest all the intelligent portion of our population.

In my first report of progress (p. 5) I have shown how useful, even indispensable, fossils are to the student of geology, and I am happy to know that their significance and value are coming to be generally appreciated. There are, however, yet some intelligent men, even editors and members of the legislature, who cherish the notion that there is nothing which has any value in this world but that thing which has a dollar in it, and that so plainly visible as to be seen by them. Such men, to quote the language of one of them, 'don't care a row of pins for your clams and salamanders, but want something practical.' Happily the class to which they belong is rapidly passing away. Were it otherwise I should endeavor to prove to them that the fossils which they despise *are* eminently practical; that they are labels written by the Creator on all the fossiliferous rocks, and that no one can be a geologist who has not learned their language."

We are promised that the final reports will consist of four volumes, of which the first two will be on Geology and Palæontology with a geological map on a large scale, vol. 3 on Economic Geology and vol. 4 on Agriculture, Botany and Zoology.

In his "Sketch of the Structure of the Lower Coal Measures in Northeastern Ohio," Prof. Newberry says that:—

"It is worth noticing, in this connection, that the Killbuck and Tuscarawas run in parallel synclinal valleys, and it seems probable that the folding of the strata which formed these subordinate troughs and ridges in our great coal basin first gave direction to the draining streams of the region we have been considering; and that, in a general way, these lines of drainage have retained, through all subsequent mutations the directions thus given them.

Our knowledge of the geology of our coal field is yet too incomplete to permit me to speak with confidence; but, from the facts already observed, I am prepared to find that the bearings of the valleys of the Ohio and all its main tributaries in our State have been determined by the same causes that produced the great folds of the Alleghany mountains.

Another interesting fact in regard to the valleys of the streams is, that they are all cut far below the present stream-beds. The valley of the Beaver is excavated to a depth of over 150 feet below the present water level. The trough of the Ohio is still deeper. The Tuscarawas, at Dover, is running 175 feet above its ancient bed. The rock bottom of the Killbuck valley has not yet been reached.

The borings made for oil along the streams of the region under consideration, as well as in other parts of the country, afford many remarkable facts bearing on this subject. They will be reported more in detail in the chapter on Surface Geology in our final report."

Prof. Andrews records an interesting discovery, as follows:

"At Zaleska, in mining the Nelsonville coal, a fine bowlder of gray quartzite was found half imbedded in the coal, and the other half in the overlying shale. The quartzite is very hard, and the bowlder was rounded and worn by friction before it came into the coal. The dimensions of the bowlder are not far from 17 inches in the longer diameter, and 12 inches in the shorter. Adhering to the stone in places are portions of coal and black slate which show the smooth surface called "slickensides." These indicate movement and pressure. Doubtless the bowlder had settled into the coal while the coal was in a comparatively soft state at the time of the bitumization.

How the bowlder came there, is a question not easily answered. That it came in at the time of the deposition of the sediments which constitute the shale over the coal, is doubtless true. But currents from which comparatively fine sediments are dropped, would hardly have force enough to move heavy bowlders. The usual explanation of isolated bowlders, such, for example, as are found over our prairies, is that they were dropped from melting icebergs or other floating ice. This explanation would require us

to account for the existence of ice during the period of the productive Coal-measures. A part of the vegetation of the coal period was allied more or less closely to the modern ferns, but these, of very large size are found chiefly in the tropics. Coal is, however, found in arctic regions. This fact has been supposed to indicate a warm climate during the coal period. There are two equally important elements in all calculations respecting the origin of coal. The first is a sufficiently warm atmosphere to secure luxuriant and abundant vegetation; the second, a climate sufficiently cool to prevent such decay of the vegetable matter as would forbid any accumulation. There is little or no accumulation of vegetable matter in the hot, damp climate of the tropics, the decay counterbalancing the growth. On the other hand, the peat vegetation accumulates in wet bogs in comparatively cold climates. Whether there may have been, after the submergence of the Zaleski coal, at some point more or less remote, a shore on which ice may have been formed, which floated the bowlder in question, or it was brought down by river ice from some higher and colder part of the old continent which was skirted by the coal producing lowlands, it is impossible to say.

Sir Charles Lyell in his "Students' Elements of Geology," published in 1871, gives the following paragraph on the climate of the coal period: 'As to the climate of the coal, the ferns and the coniferæ are, perhaps, the two classes of plants which may be most relied upon as leading to safe conclusions, as the genera are nearly allied to living types. All botanists admit that the abundance of ferns implies a moist atmosphere. But the coniferæ, says Hooker, are of a more doubtful import, as they are found in hot and dry and in cold and dry climates, in hot and moist and in cold and moist regions. In New Zealand the coniferæ attain their maximum in numbers constituting 1-62 part of all the flowering plants; whereas, in a wide district around the Cape of Good Hope they do not form 1-1600 of the phenogamic flora. Besides the conifers, many species of ferns flourish in New Zealand, some of them arborescent, together with many lycopodiums, so that a forest in that country may make a nearer approach to the Carboniferous vegetation than any other now existing on the globe.'"

The other reports will also commend themselves to geologists, and meanwhile we trust no expense will be spared by the State in causing the final report to be published and extensively circulated.

THE NOXIOUS AND BENEFICIAL INSECTS OF MISSOURI.*—Though by the time this review appears we shall have a fourth report from Mr. Riley, a notice of some of the good things in the present re-

*Third Annual Report on the Noxious, Beneficial and other Insects of the State of Missouri, etc. By Charles V. Riley, State Entomologist. 1871. 8vo, pp. 182, with 73 cuts. Price $1.00.